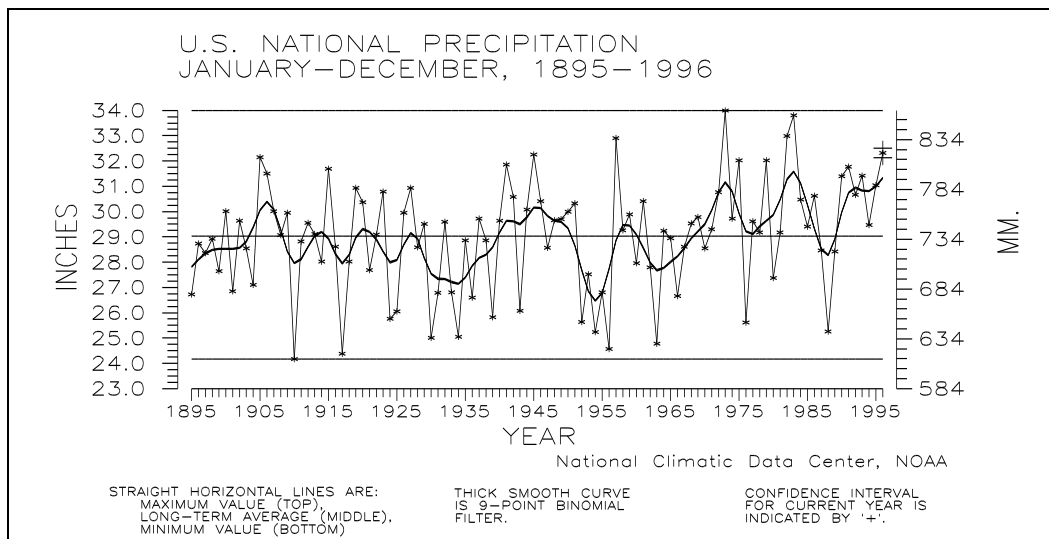
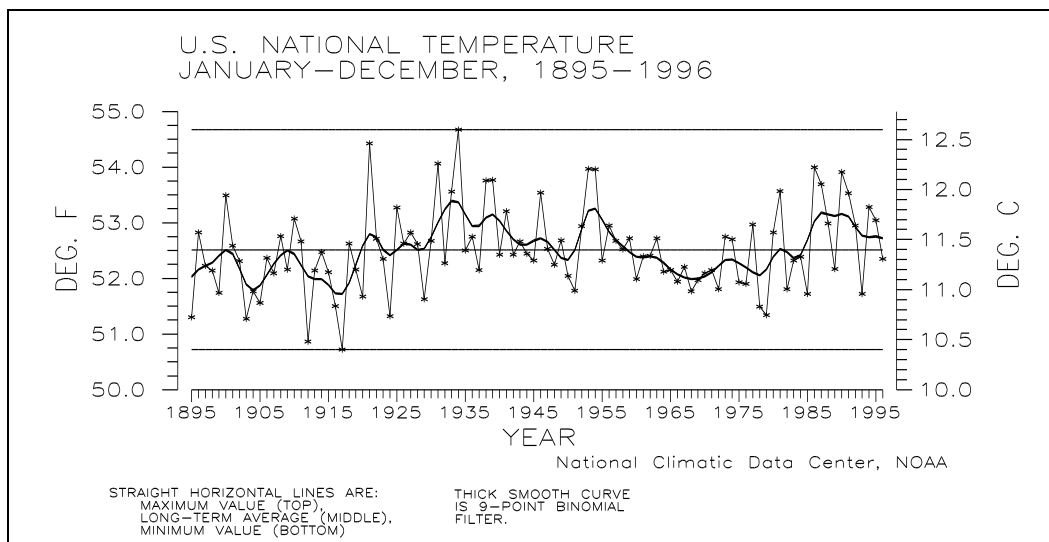


CLIMATE VARIATIONS BULLETIN



This CLIMATE VARIATIONS BULLETIN (CVB) is a preliminary report that puts current monthly climate anomalies into historical perspective using climate databases archived at the National Climatic Data Center (NCDC). It is issued on a monthly basis. Supplemental sections are included which address seasonal and annual perspectives, when appropriate.

Current data are based on preliminary reports from River Forecast Center stations and First and Second Order airport stations obtained from the National Weather Service (NWS) Climate Prediction Center (formerly, Climate Analysis Center), and preliminary tornado statistics obtained from the NWS National Severe Storms Forecast Center. THE CURRENT DATA SHOULD BE USED WITH CAUTION. These preliminary data are useful for estimating how current anomalies compare to the historical record, however the actual values and rankings for the current year will change as the final data arrive at NCDC and are processed.

The following NCDC datasets are used for the historical data: the climate division drought database (TD-9640), the hurricane datasets (TD-9636 and TD-9697), the tornado dataset (STORM DATA), and the monthly station dataset (LCD supplemental files). It should be noted that the climate division drought database consists of monthly data for 344 climate divisions in the contiguous United States. These divisional values are calculated from the 6000+ station Cooperative Observer network.

If you have access to the Internet, copies of the CVB are available via both the NCDC's World Wide Web (WWW) server and the NCDC's anonymous FTP server.

NCDC's WWW server

URL for the CVB: <http://www.ncdc.noaa.gov/publications/cvb/cvb.html>

NCDC's anonymous FTP server

Machine: <ftp.ncdc.noaa.gov>

Directory: [/pub/data/cvb](ftp://ftp.ncdc.noaa.gov/pub/data/cvb)

If you are a climate researcher and would like to order copies of the historical datasets used to make graphs of the type in this report, call 704-271-4994 or fax a letter to 704-271-4876 or mail a letter to the address given below, ATTN: Research User Services.

All other questions or requests for data should be made by calling 704-271-4800 or sending a fax to 704-271-4876 or by writing to:

National Climatic Data Center, NOAA
Federal Building
151 Patton Avenue, Room 120
Asheville, NC 28801-5001

If you use any of the information from this CVB, please identify "National Climatic Data Center, NOAA" as the source.

UNITED STATES DECEMBER AND ANNUAL CLIMATE IN HISTORICAL PERSPECTIVE

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Table 1. Precipitation and Temperature Ranks, Based
On the Period 1895-1996. 1 = Driest/Coldest,
102 = Wettest/Warmest for December 1996,
102 = Wettest/Warmest for Nov-Dec 1996,
102 = Wettest/Warmest for Jul-Dec 1996,
102 = Wettest/Warmest for Jan-Dec 1996.

Region	Dec 1996	Nov-Dec 1996	Jul-Dec 1996	Jan-Dec 1996
-----	----	-----	-----	-----
Precipitation:				
Northeast	95	86	99	102
East North Central	64	74	57	67
Central	25	58	70	88
Southeast	27	49	78	73
West North Central	101	102	97	86
South	14	60	92	44
Southwest	45	57	67	45
Northwest	102	102	102	102
West	101	102	100	97
National	89	96	102	98
Temperature:				
Northeast	98	74	58	36
East North Central	42	15	15	9
Central	73	33	8	10
Southeast	73	49	25	18
West North Central	25	10	12	12
South	79	66	30	47
Southwest	86	85	84	99
Northwest	62	63	67	72
West	93	92	95	101
National	74	44	34	47

Table 2. Extremes, 1961-90 Normals, and 1996 Values For Dec. It Should Be Noted That the 1996 Values Will Change When the Final Data Are Processed.

Region	Precipitation (Inches)				Normal Pcpn	1996 Pcpn
	Driest Value	Year	Wettest Value	Year		
Northeast	.98	1955	6.74	1973	3.45	5.02
East North Central	.37	1943	2.62	1982	1.44	1.38
Central	.90	1958	7.58	1990	3.44	2.14
Southeast	1.18	1955	7.05	1953	3.87	2.80
West North Central	.19	1986	1.20	1917	.65	1.18
South	.64	1917	5.51	1911	2.49	1.52
Southwest	.11	1929	2.29	1965	.96	.68
Northwest	1.17	1976	8.38	1996	4.03	8.38
West	.09	1989	7.05	1955	2.33	6.89
National	1.22	1958	3.60	1982	2.30	2.78*

* Preliminary Value, Confidence Interval + or - .09 Inches

Region	Temperature (Degrees F)				Normal Temp	1996 Temp
	Coldest Value	Year	Warmest Value	Year		
Northeast	13.3	1989	34.5	1923	26.6	32.8
East North Central	6.9	1983	29.0	1923	18.6	18.2
Central	21.9	1989	42.0	1923	33.0	36.0
Southeast	39.3	1989	55.9	1931	47.3	49.4
West North Central	4.3	1983	30.0	1939	19.4	17.1
South	33.6	1983	51.0	1933	43.5	46.4
Southwest	24.8	1909	39.9	1980	32.6	36.1
Northwest	21.9	1990	37.9	1917	29.4	31.3
West	33.0	1990	45.6	1929	38.7	42.8
National	25.8	1983	38.4	1939	32.8	34.9*

* Preliminary Value, Confidence Interval + or - .1 Deg. F.

Table 3.

Statistics for Selected River Basins: Precipitation Ranking for Oct-Dec 1996, Where Rank of 1 = Driest, 102 = Wettest, Based on the Period 1895 to 1996; Areal Percent of the Basin Experiencing Severe or Extreme Long-term (Palmer) Drought, and Areal Percent Of the Basin Experiencing Severe or Extreme Long-term (Palmer) Wet Conditions, as of December 1996. River Basin Regions as Defined by the U.S. Water Resources Council.

River Basin -----	Precipitation Rank -----	% Area Dry -----	% Area Wet -----
Missouri Basin	97	.0%	66.5%
Pacific Northwest Basin	102	.0%	82.3%
California River Basin	101	.0%	62.4%
Great Basin	100	.0%	38.3%
Upper Colorado Basin	99	.0%	23.6%
Lower Colorado Basin	25	59.6%	.0%
Rio Grande Basin	39	.0%	.0%
Arkansas-White-Red Basin	57	.0%	16.9%
Texas Gulf Coast Basin	40	.0%	.0%
Souris-Red-Rainy Basin	94	.0%	85.4%
Upper Mississippi Basin	74	.0%	19.9%
Lower Mississippi Basin	62	.0%	8.5%
Great Lakes Basin	70	.0%	36.3%
Ohio River Basin	40	.0%	30.5%
Tennessee River Basin	62	.0%	39.6%
New England Basin	90	.0%	62.2%
Mid-Atlantic Basin	93	.0%	81.1%
South Atlantic-Gulf Basin	51	.0%	2.3%

Table 4. Extremes, 1961-90 Normals, and 1996 Values
For Jan-Dec

Region	Precipitation (Inches)				Normal Pcpn	1996 Pcpn
	Driest Value	Year	Wettest Value	Year		
Northeast	31.77	1930	52.66	1996	41.63	52.66
East North Central	19.81	1910	36.63	1951	30.50	31.04
Central	30.56	1930	53.38	1990	43.05	47.28
Southeast	37.56	1954	62.39	1929	51.03	53.71
West North Central	11.49	1934	22.86	1915	16.92	19.17
South	23.40	1917	46.91	1973	35.72	33.98
Southwest	7.68	1956	22.10	1941	13.64	13.06
Northwest	19.00	1929	37.85	1996	27.50	37.85
West	9.97	1947	31.47	1983	16.51	23.80
National	24.17	1910	33.99	1973	29.46	32.32*

* Preliminary Value, Confidence
Interval + or - .19 Inches

Region	Temperature (Degrees F)				Normal Temp	1996 Temp
	Coldest Value	Year	Warmest Value	Year		
Northeast	43.1	1904	48.9	1953	46.1	46.0
East North Central	39.5	1917	48.0	1931	43.5	41.5
Central	50.6	1917	56.9	1921	53.2	52.2
Southeast	61.0	1901	65.0	1921	62.4	61.9
West North Central	39.9	1916	46.7	1934	43.3	41.4
South	60.4	1979	64.9	1921	62.0	62.3
Southwest	49.5	1912	54.6	1934	51.8	53.8
Northwest	44.1	1955	50.2	1934	46.7	47.1
West	53.0	1911	57.8	1934	55.0	57.3
National	50.7	1917	54.7	1934	52.4	52.3*

* Preliminary Value, Confidence
Interval + or - .0 Deg. F.

Table 5.

Statistics for Selected River Basins: Precipitation
Ranking for Jan-Dec 1996, Where Rank of 1 = Driest,
102 = Wettest, Based on the Period 1895 to 1996.
River Basin Regions as Defined by the U.S. Water
Resources Council.

River Basin -----	Precipitation Rank -----
Missouri Basin	84
Pacific Northwest Basin	102
California River Basin	95
Great Basin	93
Upper Colorado Basin	68
Lower Colorado Basin	14
Rio Grande Basin	32
Arkansas-White-Red Basin	67
Texas Gulf Coast Basin	26
Souris-Red-Rainy Basin	68
Upper Mississippi Basin	56
Lower Mississippi Basin	42
Great Lakes Basin	91
Ohio River Basin	99
Tennessee River Basin	79
New England Basin	100
Mid-Atlantic Basin	102
South Atlantic-Gulf Basin	66

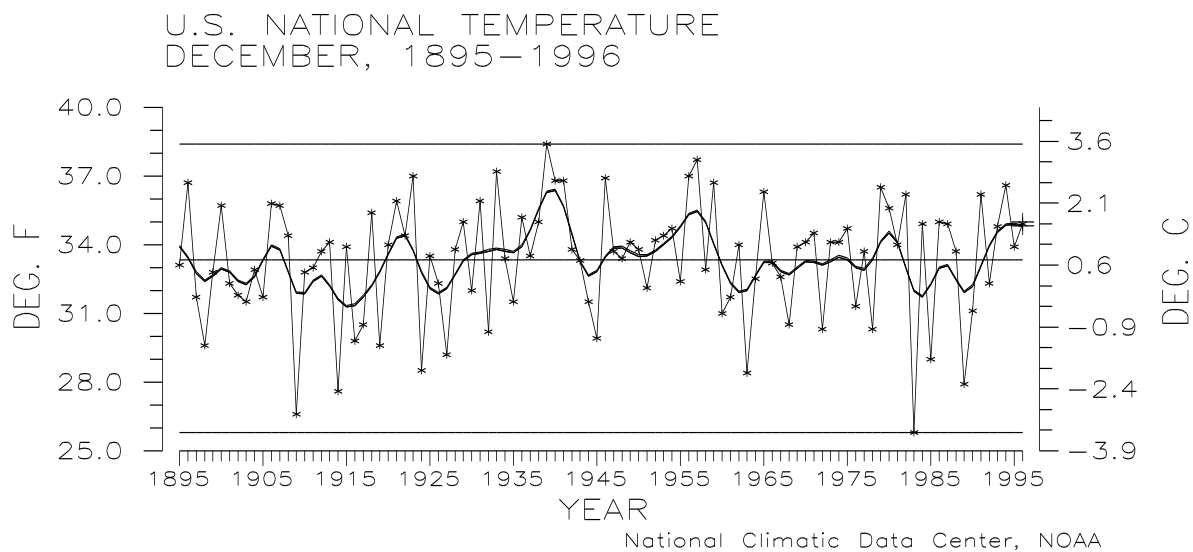


Figure 1: Preliminary data for December 1996 indicate that temperature averaged across the contiguous United States was above the long-term mean, ranking as the 29th warmest December since 1895. About nine percent of the country averaged much warmer than normal, while approximately 2% averaged much cooler than normal for the month.

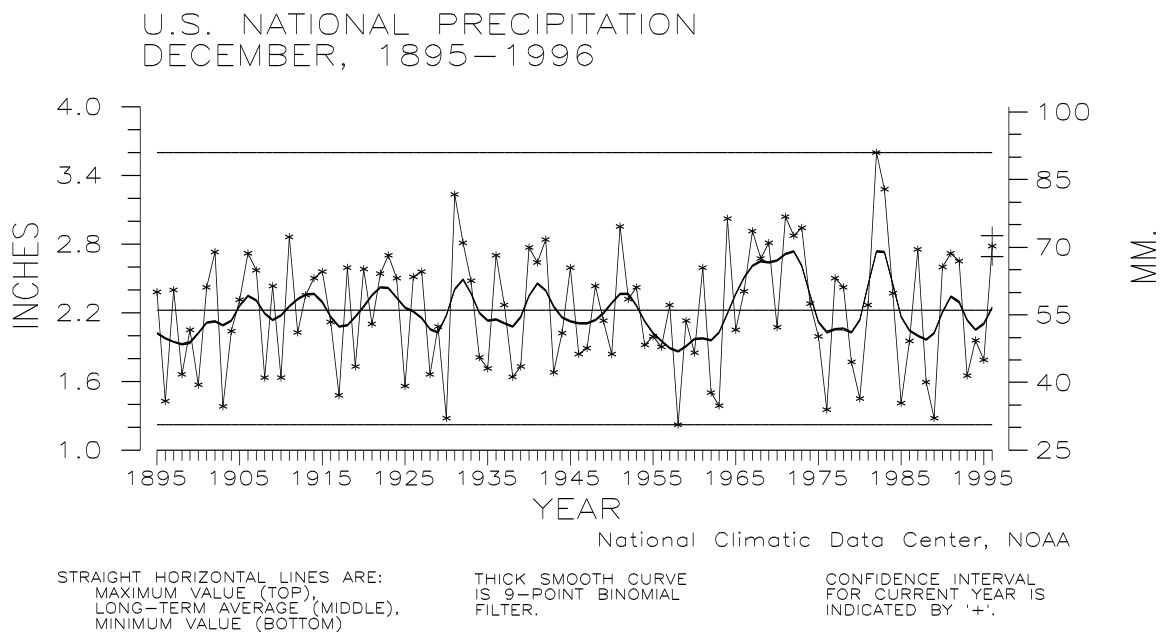


Figure 2: Preliminary data for December 1996 indicate that precipitation averaged across the contiguous United States was much above the long-term mean, ranking as the 14th wettest December since 1895. Over one-fifth (22.4%) of the country averaged much wetter than normal, while over a sixth (17.3%) was much drier than normal.

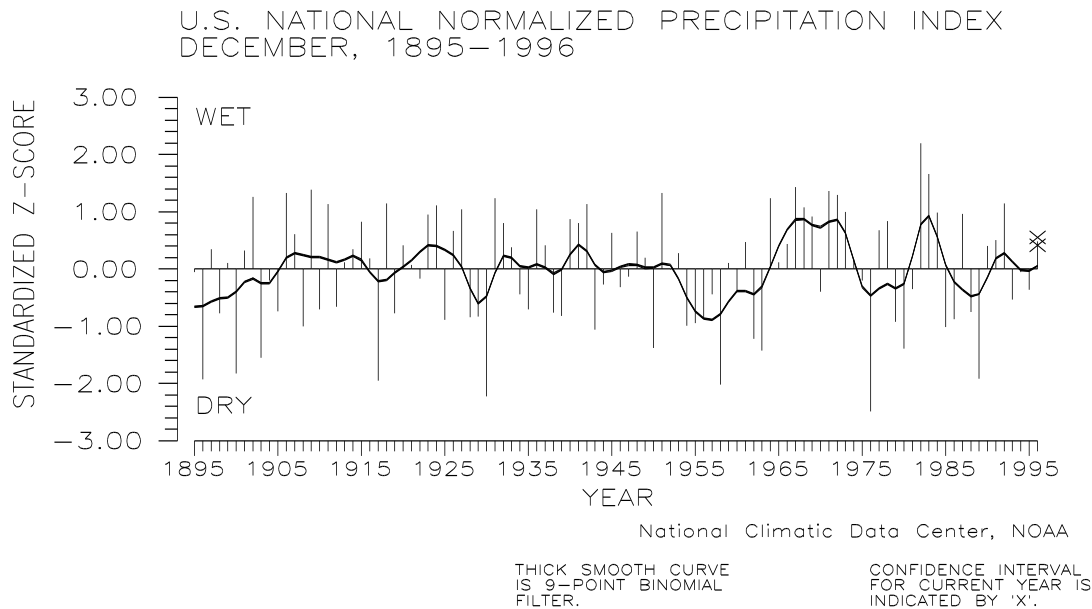


Figure 3: The preliminary national standardized precipitation index ranked December 1996 as the 21th wettest December on record. This standardized z-score is estimated to be accurate to within 0.07 index units and its confidence interval is shown as an 'X'.

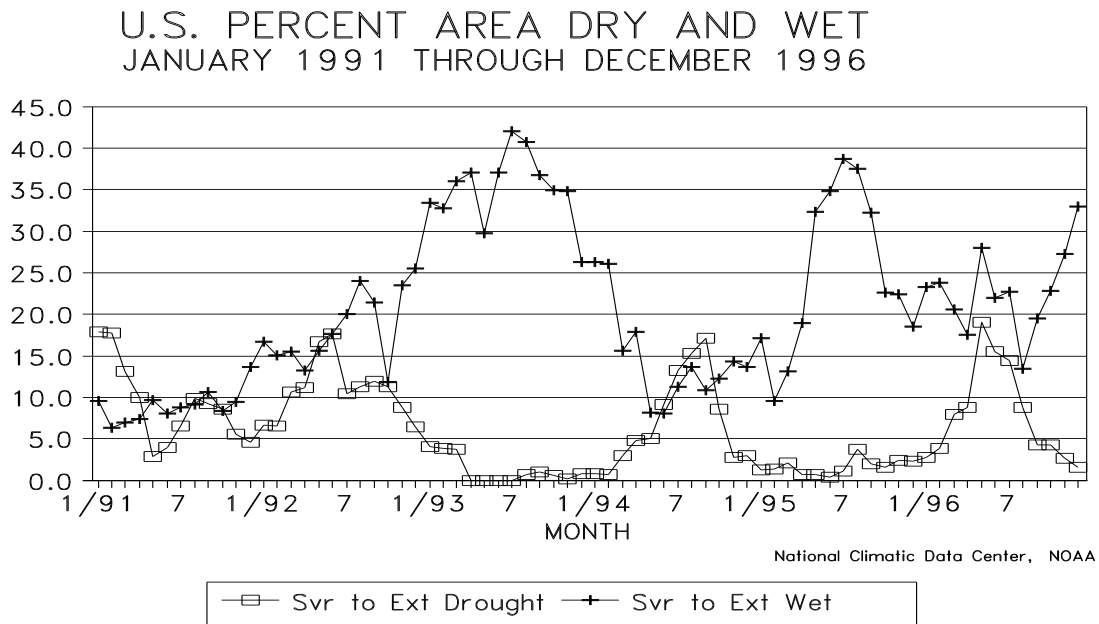


Figure 4: Long-term drought coverage (as measured by the Palmer Drought Index) continued its overall decreasing trend during December 1996. The percent area of the country experiencing severe to extreme wetness continued its recent rising trend, reaching 36% by the end of December. Core wet areas included most of the Northwest, Pacific Coast, Great Basin, Northern Rockies, Northern Plains, as well as the mid-Atlantic States, and New England. Core dry areas included only portions of the desert Southwest.

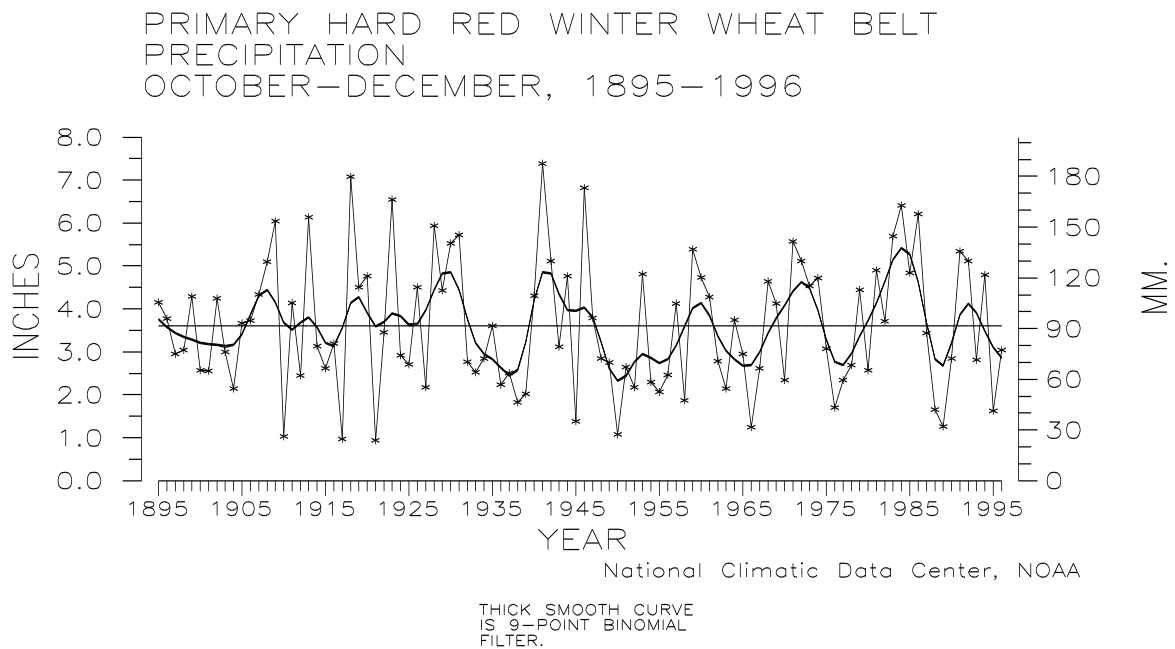


Figure 5: Total precipitation during the first three months of the growing season for the Primary Hard Red Winter Wheat Belt averaged below normal.

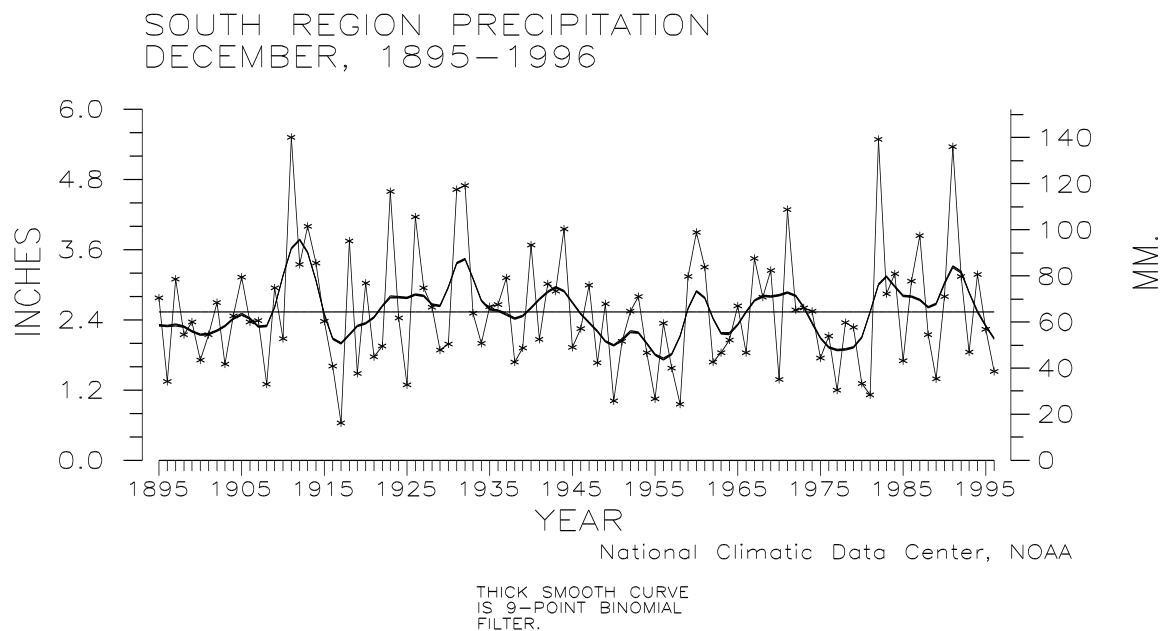


Figure 6: December 1996 was the 14th driest such month since 1895 for the South region. This region includes the states of Arkansas, Kansas, Louisiana, Mississippi, Oklahoma, and Texas.

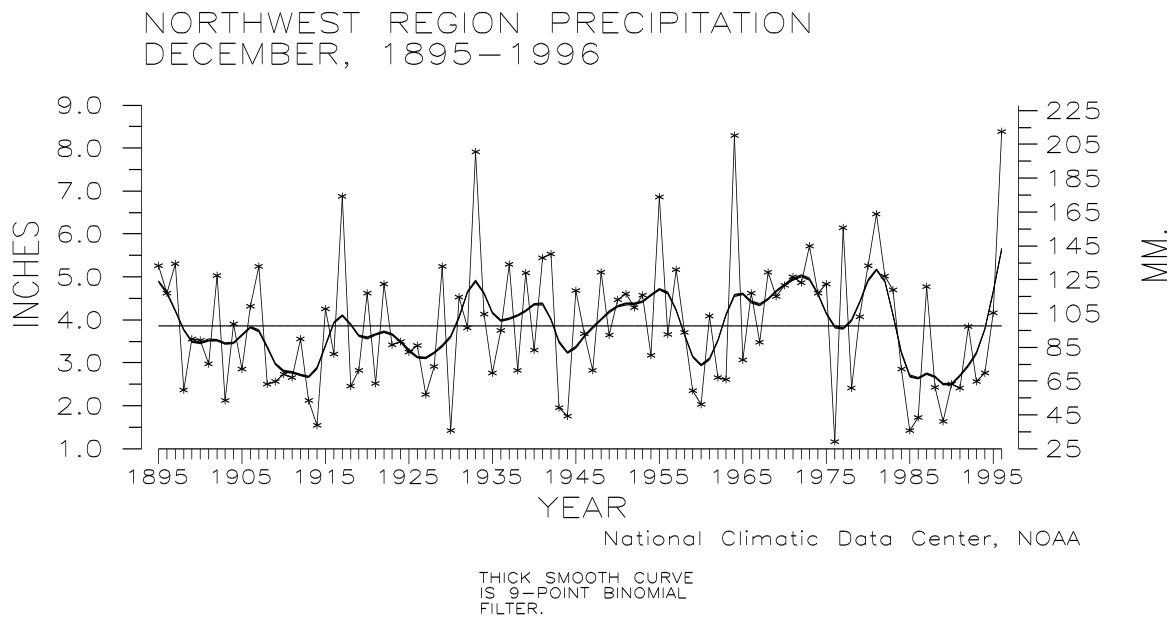


Figure 7: Based upon preliminary data, December 1996 was the wettest such month since records began for the Northwest region and breaks a 12-year pattern of near normal to very dry Decembers. This region includes the states of Idaho, Oregon, and Washington.

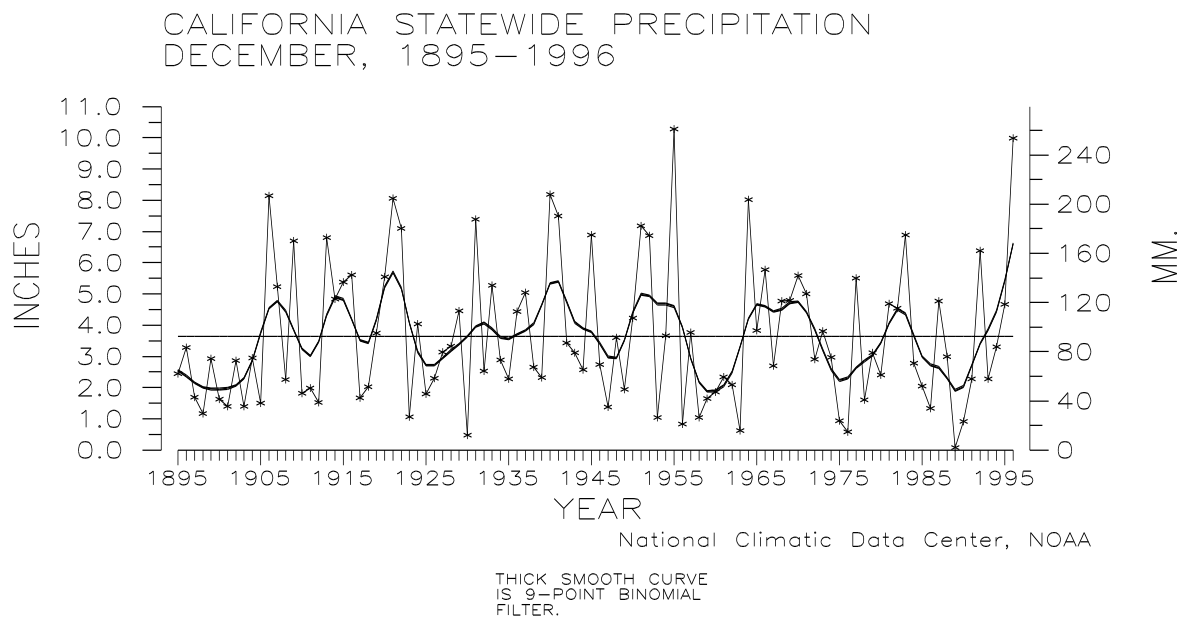


Figure 8: Due to a persistent storm track pushing one storm after another onshore along the Pacific coast, December 1996 was the second wettest such month since 1895 for California. Statewide averaged precipitation for the month totaled 9.98 inches, three-tenths of an inch less than the record wet December of 1955.

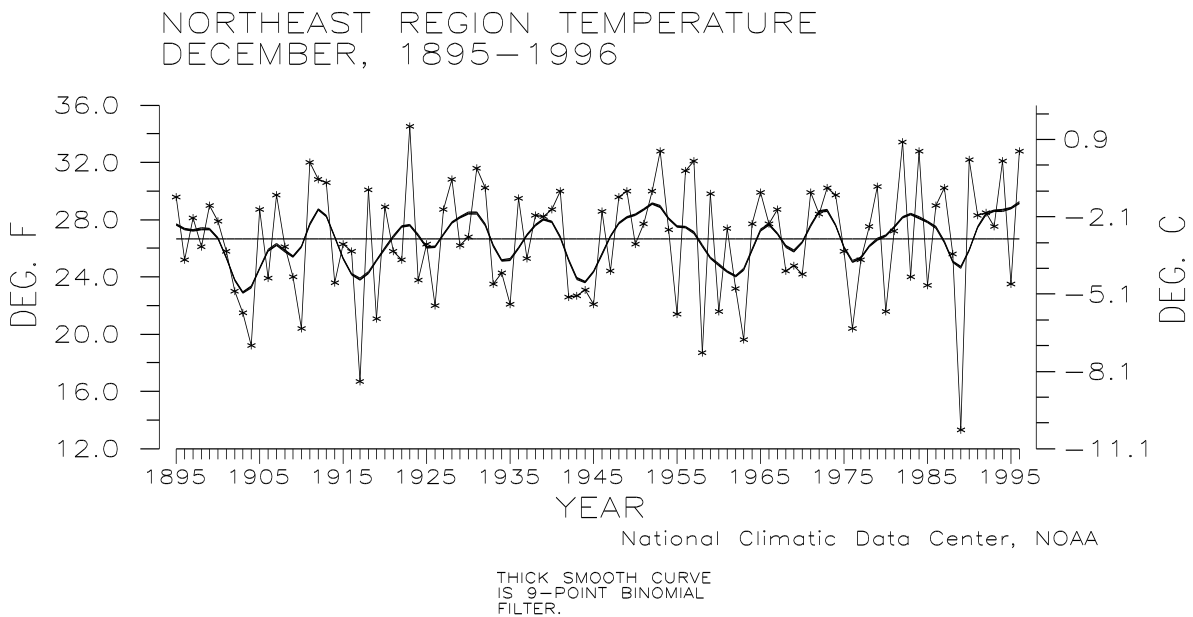


Figure 9: Preliminary data indicate that December 1996 was the fifth warmest such month on record for the Northeast region.

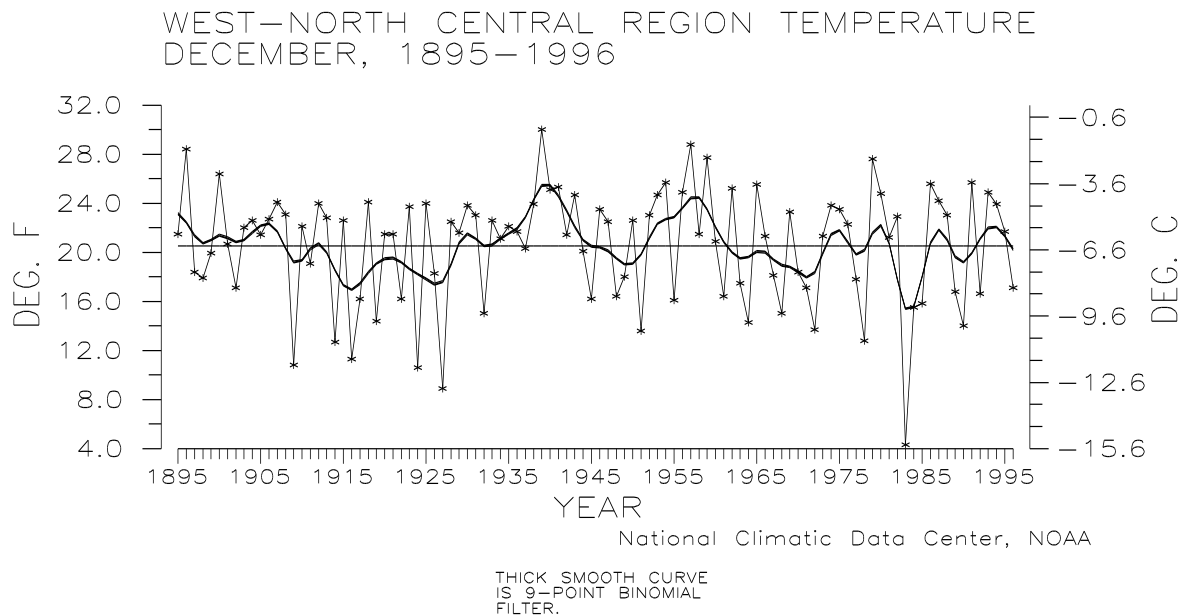
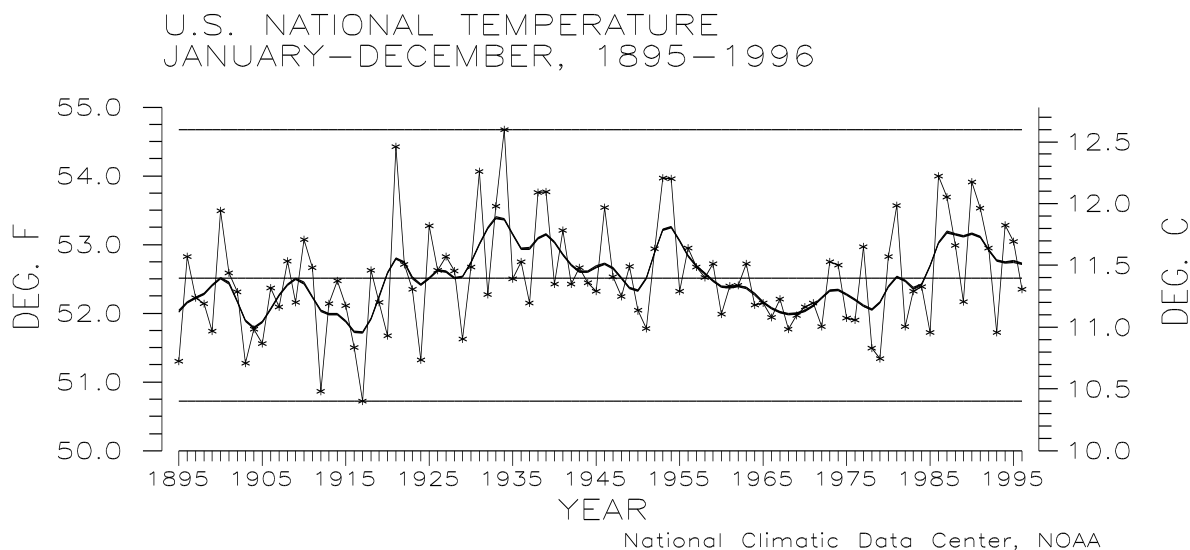


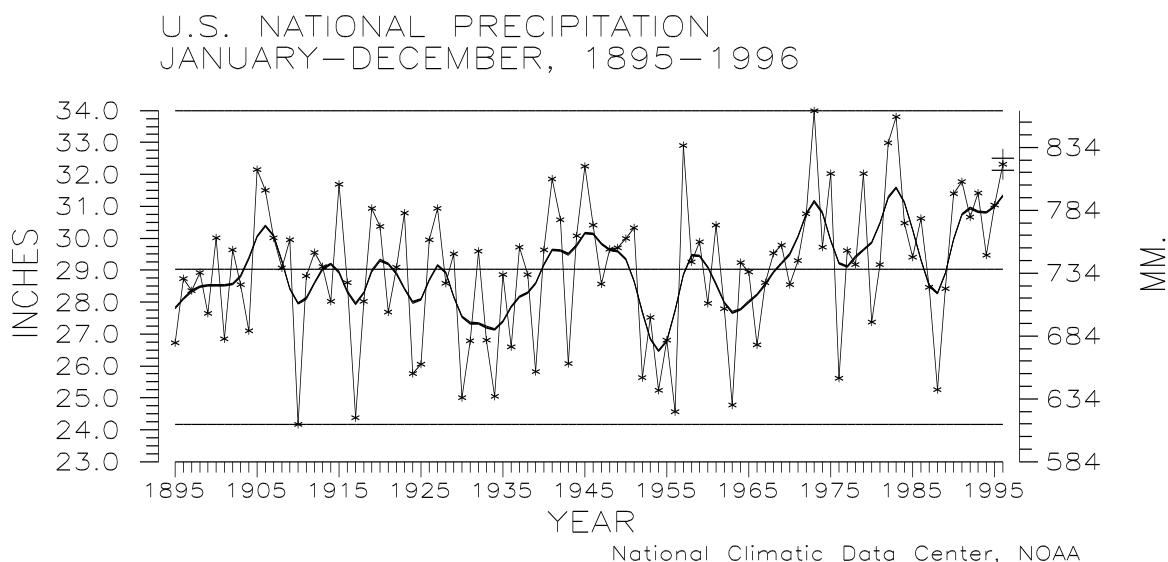
Figure 10: December 1996 was the 25th coolest such month for the West-North Central Region. This region includes the states of Montana, Wyoming, Nebraska, North Dakota, and South Dakota.



STRAIGHT HORIZONTAL LINES ARE:
 MAXIMUM VALUE (TOP),
 LONG-TERM AVERAGE (MIDDLE),
 MINIMUM VALUE (BOTTOM)

THICK SMOOTH CURVE
 IS 9-POINT BINOMIAL
 FILTER.

Figure 11: Preliminary data indicate that Annual 1996 temperature averaged across the contiguous United States was near the long-term mean, ranking 1996 as the 47th coolest year on record. About a fifth (19.8%) of the country averaged much warmer than normal for the year, while one sixth (17.5%) averaged much colder than normal.



STRAIGHT HORIZONTAL LINES ARE:
 MAXIMUM VALUE (TOP),
 LONG-TERM AVERAGE (MIDDLE),
 MINIMUM VALUE (BOTTOM)

THICK SMOOTH CURVE
 IS 9-POINT BINOMIAL
 FILTER.

CONFIDENCE INTERVAL
 FOR CURRENT YEAR IS
 INDICATED BY '+'.

Figure 12: Preliminary data indicate that Annual 1996 precipitation averaged across the contiguous United States was well above the long-term mean, ranking 1996 as the fifth wettest year on record. Annual 1996 national precipitation fit the pattern that has dominated since the early 1970's, that is, with few exceptions, near to much wetter than normal.

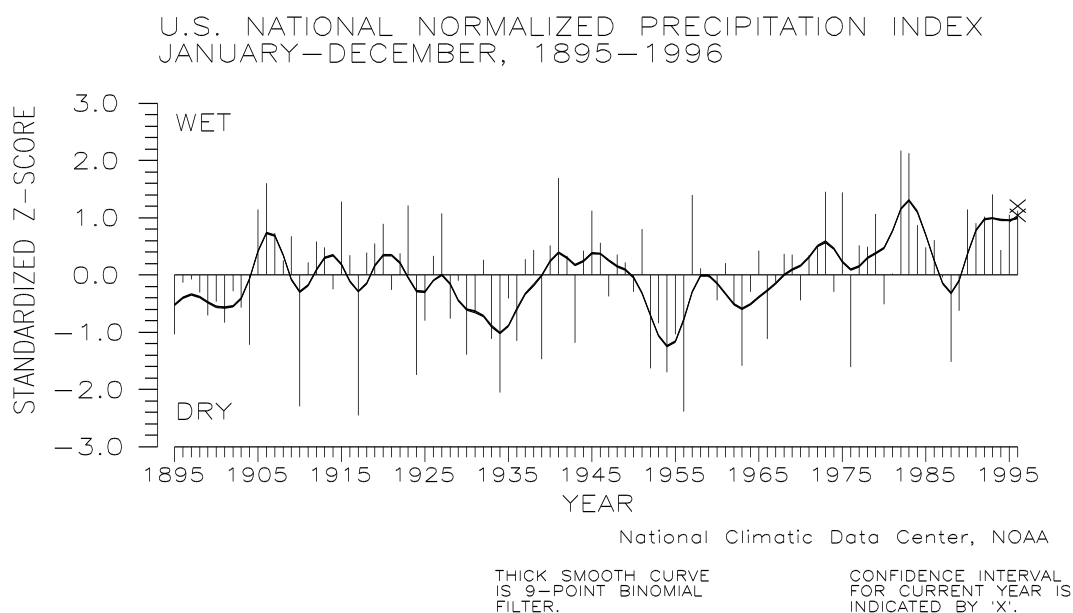


Figure 13: The preliminary national annual standardized precipitation index ranked 1996 as the 14th wettest year on record. This standardized z-score is estimated to be accurate to within 0.083 index units. About a fourth (25.8%) of the country averaged much wetter than normal for the year, with only 2.3% averaging much drier than normal.

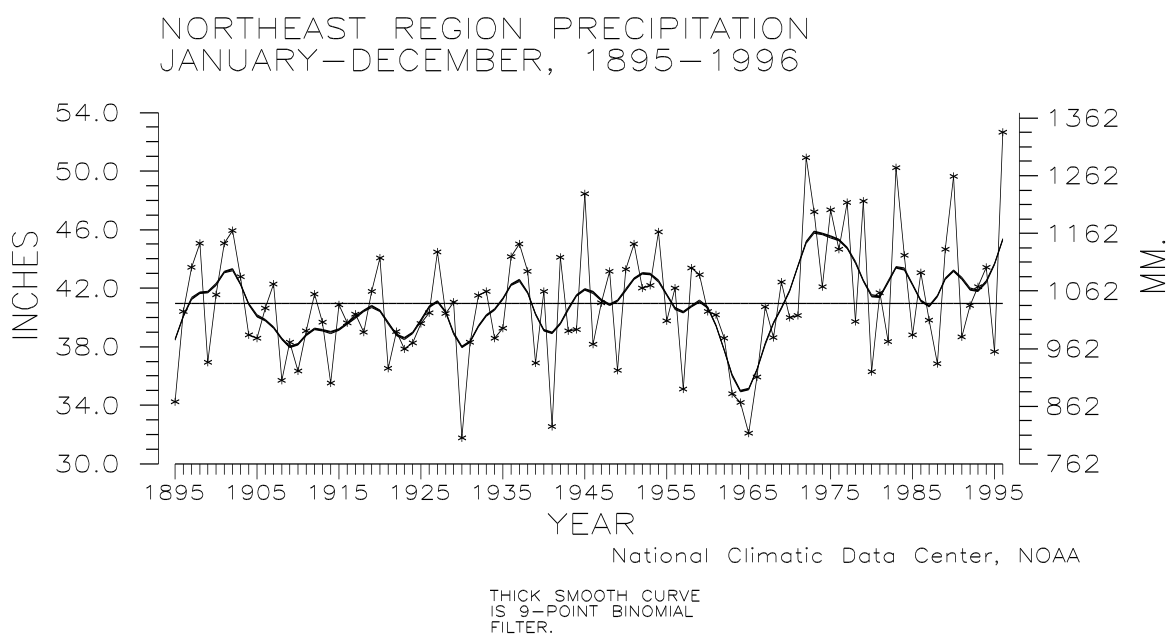


Figure 14: The Northeast region had the wettest year on record in 1996. Unusual wetness has occurred often since the dry 1960's.

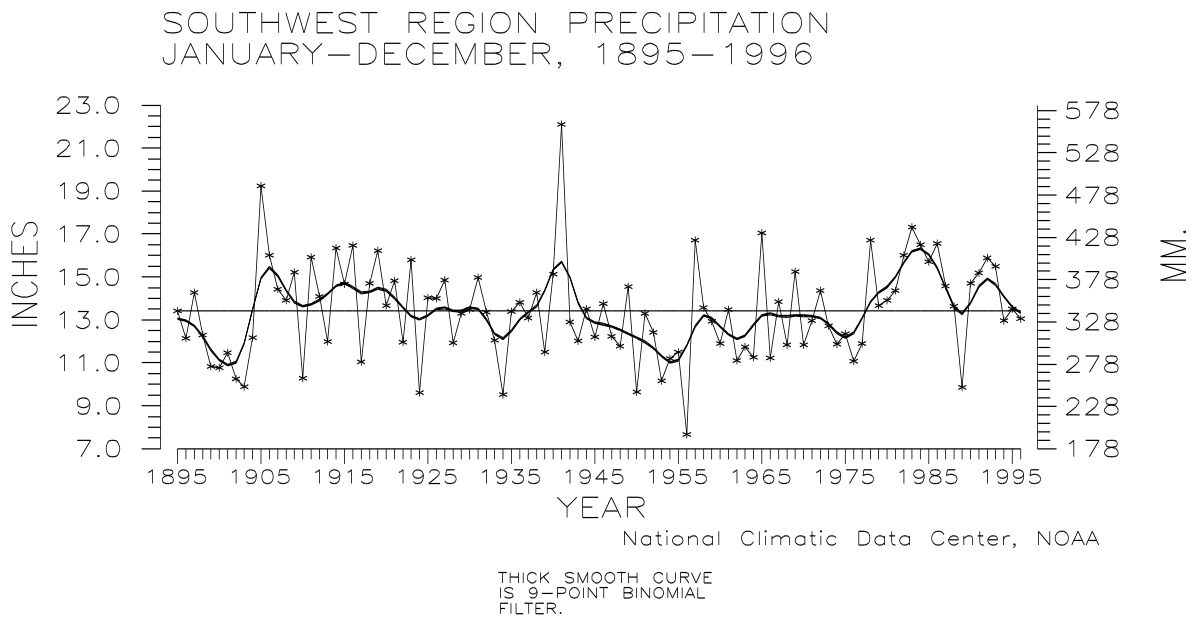


Figure 15: The Southwest region (AZ, CO, NM, UT) had the 45th driest year in 1996.

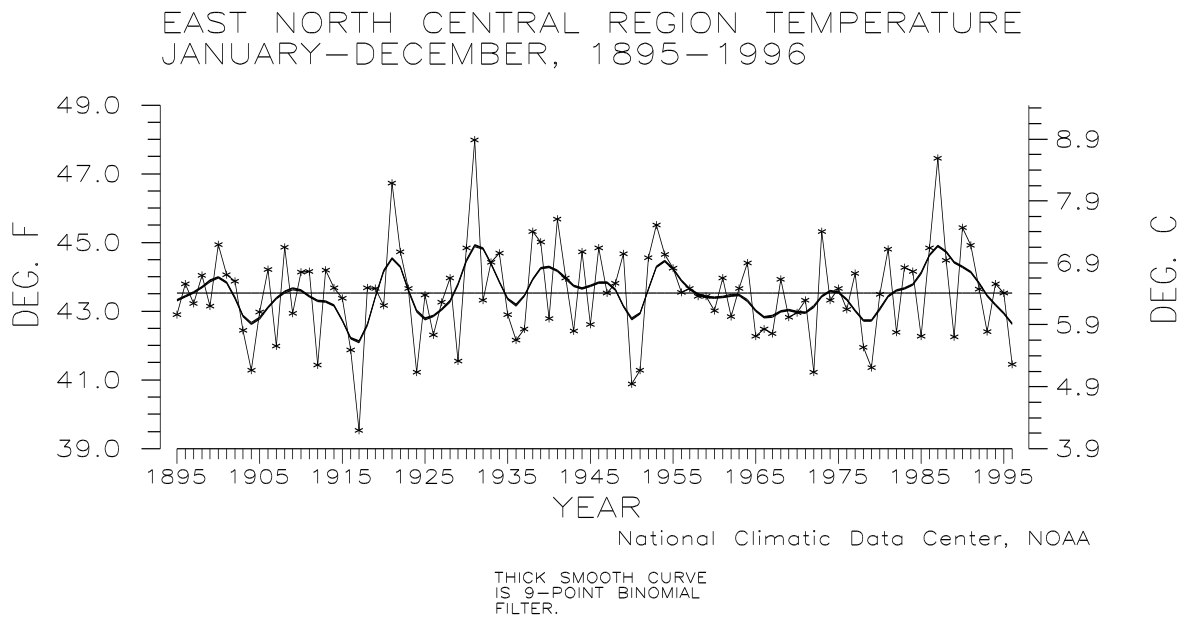


Figure 16: Of the nine regions in the contiguous U.S., the East North Central region had the coldest annual temperature rank, with 1996 ranking as the ninth coldest year in the last 102 years.

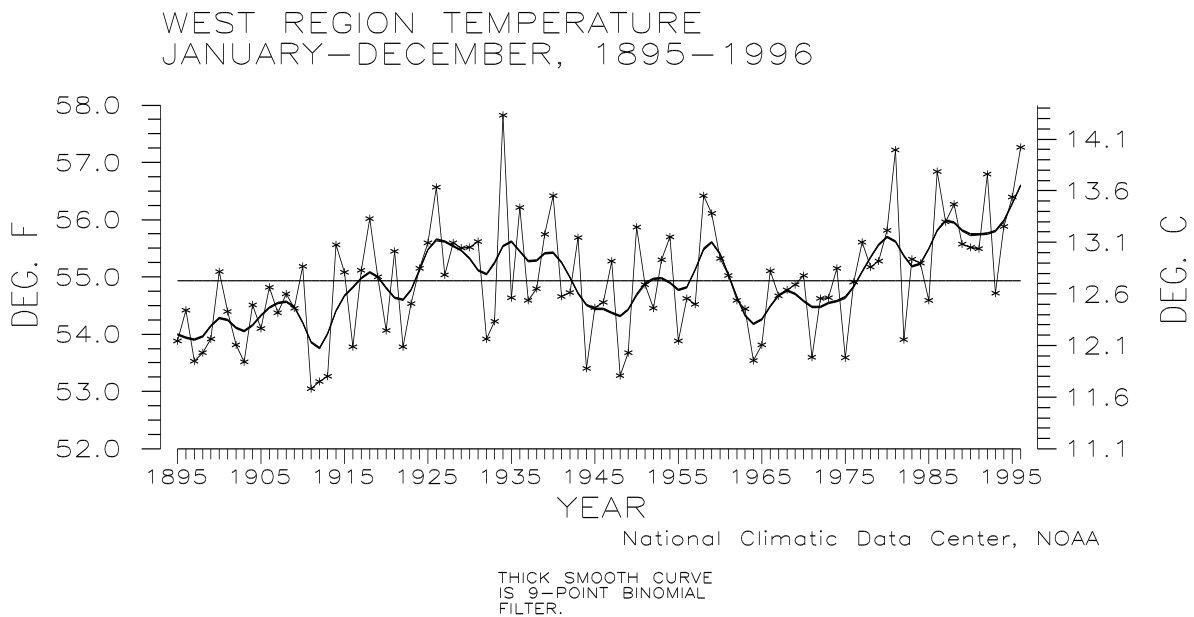


Figure 17: Preliminary data indicate the West region had the second warmest year on record in 1996. Warm to very warm annual mean temperatures have dominated the last two decades.

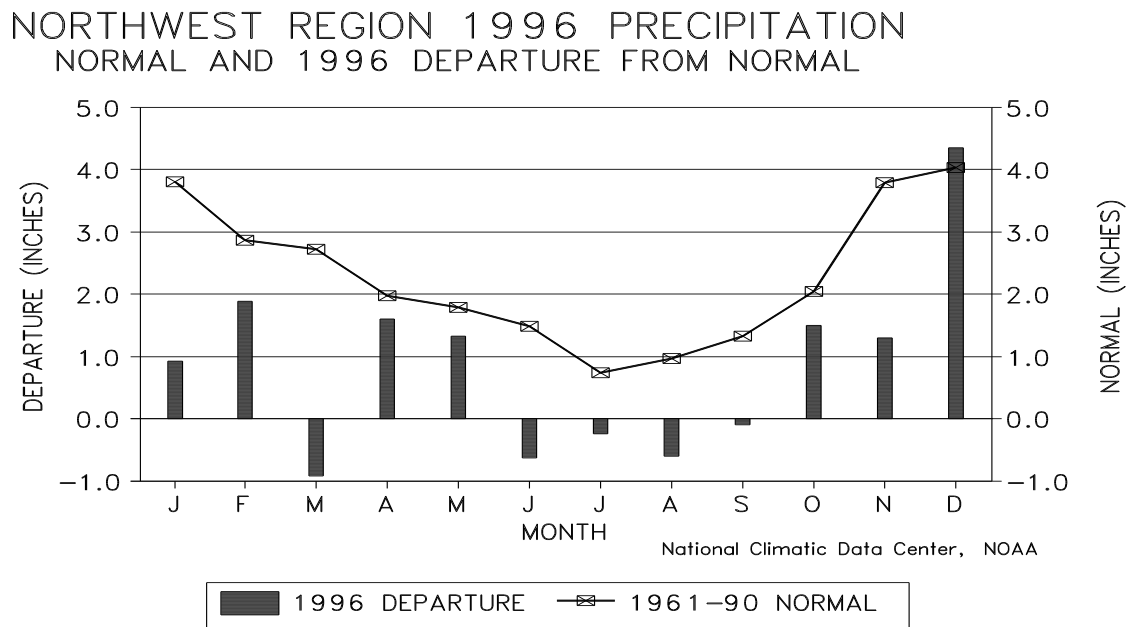


Figure 18: The record wet year in 1996 for the Northwest region was the culmination of abnormally wet conditions during 7 of the 12 months, with December 1996 being especially wet at twice its normal precipitation.

NORTHEAST REGION 1996 PRECIPITATION NORMAL AND 1996 DEPARTURE FROM NORMAL

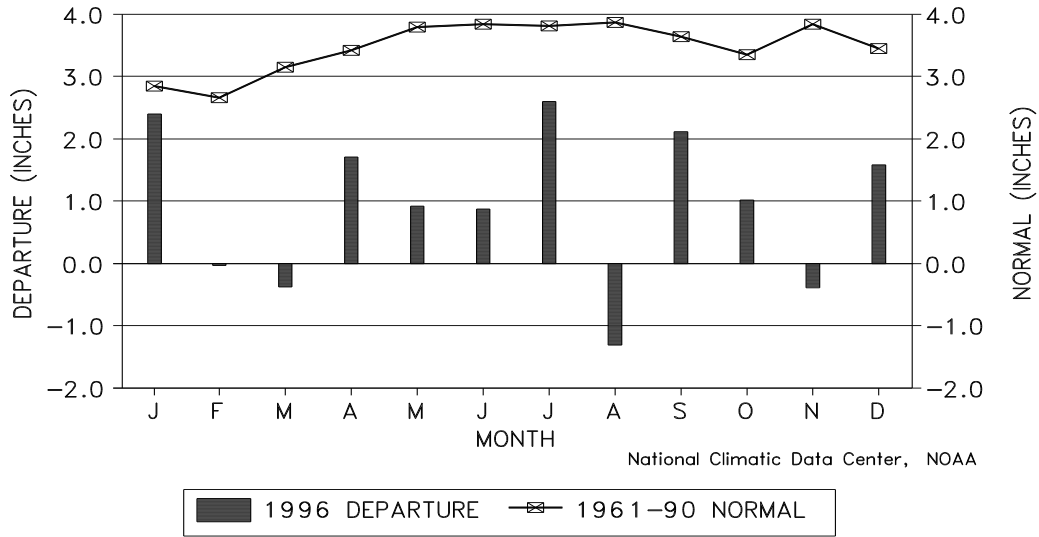


Figure 19: The record wet year in 1996 for the Northeast region resulted from abnormally wet conditions during 8 of the 12 months.

SOUTH REGION 1996 PRECIPITATION NORMAL AND 1996 DEPARTURE FROM NORMAL

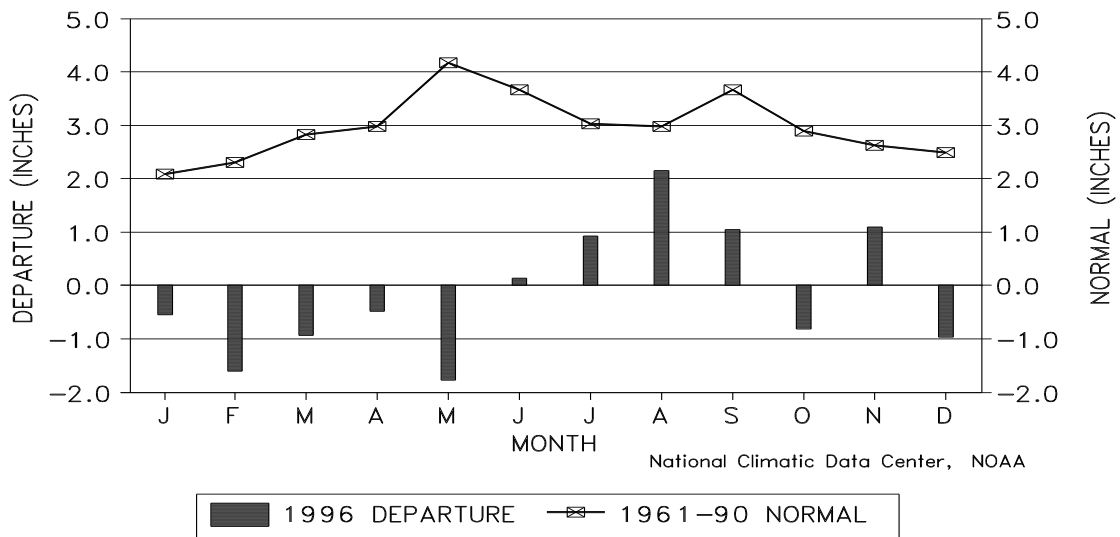


Figure 20: For the South region, 1996 started out dry with persistent monthly precipitation deficits resulting in severe drought during the spring. Abundant summer rains brought relief from the drought, with severe drought ending in most parts of the region by year's end.

EAST NORTH CENTRAL REGION TEMPERATURE NORMAL AND 1996 DEPARTURE FROM NORMAL

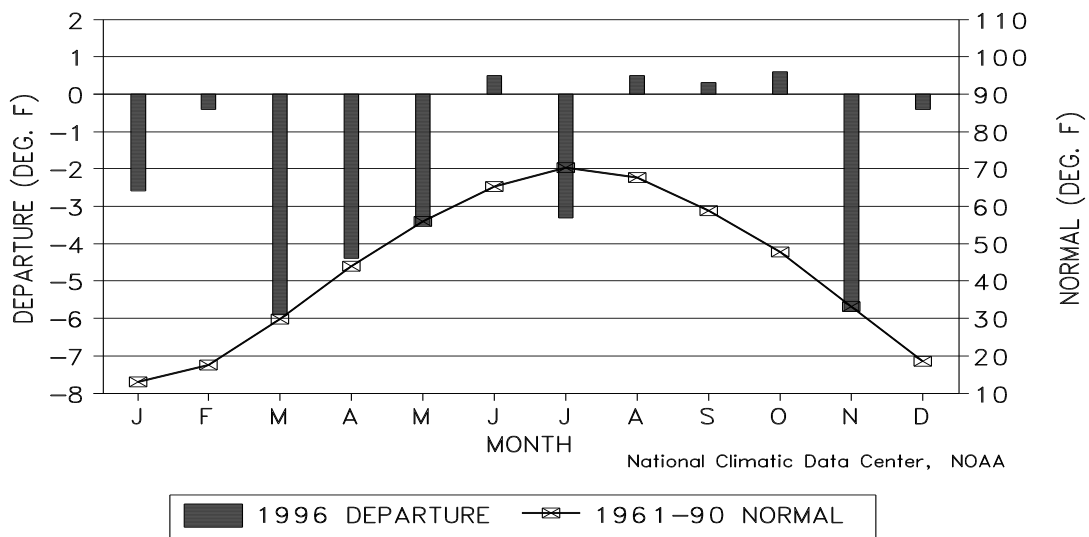


Figure 21: Unusually cold temperatures during six of the 12 months in 1996 resulted in the ninth coldest year on record for the East North Central region.

WEST REGION 1996 TEMPERATURE NORMAL AND 1996 DEPARTURE FROM NORMAL

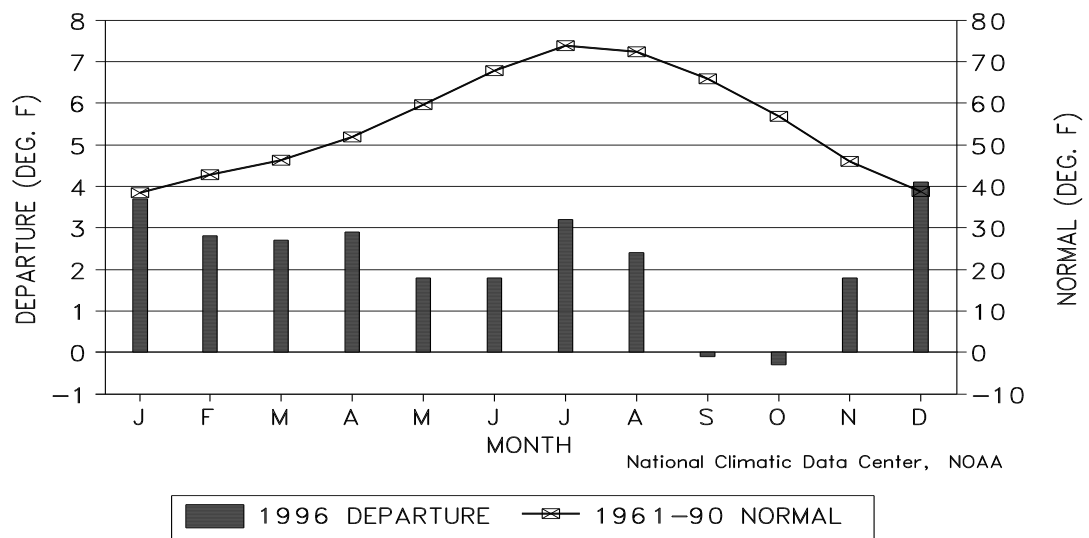


Figure 22: Warm temperature departures occurred in the West region during every month of 1996 except two. This persistent warmth resulted in the second warmest year on record for the region.

Figure 23A: Average annual temperature by state for 1981-2010. The map shows the following temperature ranges (in degrees Fahrenheit) for each state:

- Alaska: 102
- Arizona: 83
- California: 90
- Colorado: 54
- Connecticut: 95
- Delaware: 93
- District of Columbia: 94
- Florida: 65
- Georgia: 71
- Idaho: 21
- Illinois: 59
- Indiana: 71
- Iowa: 34
- Kansas: 58
- Kentucky: 84
- Louisiana: 75
- Maine: 98
- Massachusetts: 95
- Michigan: 65
- Minnesota: 25
- Mississippi: 80
- Missouri: 32
- Montana: 21
- Nebraska: 13
- Nevada: 93
- New Hampshire: 98
- New Jersey: 98
- New Mexico: 69
- New York: 89
- North Carolina: 72
- North Dakota: 13
- Ohio: 87
- Oklahoma: 81
- Oregon: 80
- Rhode Island: 95
- South Carolina: 73
- South Dakota: 32
- Tennessee: 86
- Texas: 82
- Vermont: 98
- Virginia: 86
- Washington: 21
- West Virginia: 87
- Wisconsin: 51
- Wyoming: 88

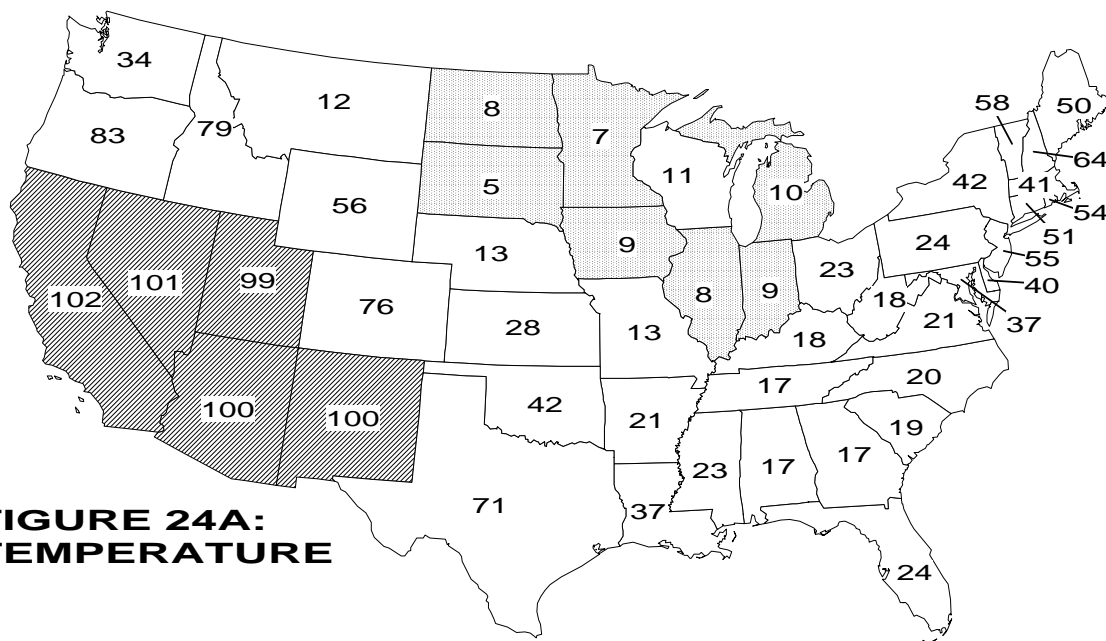
FIGURE 23B: PRECIPITATION

1 = Coldest/Driest

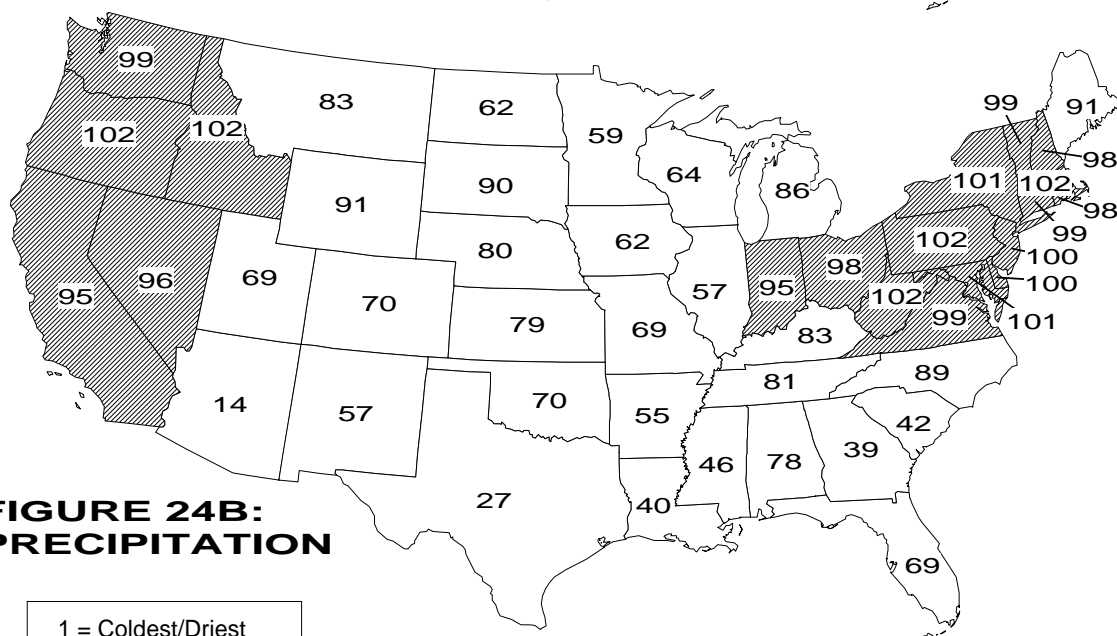
National Climatic Data Center, NOAA

18

ANNUAL (JAN-DEC) 1996 STATEWIDE RANKS



**FIGURE 24A:
TEMPERATURE**



**FIGURE 24B:
PRECIPITATION**

1 = Coldest/Driest
102 = Warmest/Wettest

National Climatic Data Center, NOAA

Temperature and Precipitation Ranks for the contiguous United States. Each state is ranked based on its data from 1895-1996. States having a rank of top ten coldest or driest (rank 1-10) or top ten warmest or wettest (rank 93-102) are shaded.

The maps show the 1996 temperature and precipitation ranks for the 48 contiguous states. The December 1996 ranks are shown in Figures 23A (temperature) and 23B (precipitation). Ten states ranked within the top ten warm category including the warmest December on record for Vermont. It was the second warmest December since 1895 for Maine, and the fifth warmest December for New Hampshire and New York. Thirty-four states ranked within the warm-third of the historical distribution for December 1996. No states ranked within the top ten cool portion of the distribution while only seven, located mostly in the Northern Plains, ranked within the cool third of the historical distribution.

Unusually wet conditions characterized December 1996, with 14 states ranking in the top ten wettest category. It was the wettest December since records began for Idaho, Montana, Nevada, and Wyoming. It was the second wettest December since 1895 for California (Figure 8) and Oregon, third wettest for Washington, fourth wettest for New Jersey and Rhode Island, and fifth wettest December since 1895 for Vermont. In all, 24 states ranked within the wet-third of the historical distribution. Three states, Kansas (third driest), Nebraska (ninth driest), and New Mexico (tenth driest) were within the top ten dry portion of the distribution for December while 15 others were within the dry third of the historical distribution.. ***It should be noted that these December state categorical precipitation ranks are preliminary and should be used with considerable caution due to the high variability of precipitation on a small space and time scale.***

The annual 1996 ranks for the 48 contiguous states are shown in Figures 24A (temperature) and 24B (precipitation). Unusually warm temperatures dominated the southwestern third of the U.S., with five states having average annual temperatures in the top ten warmest category. Annual temperatures averaged unusually cold for much of the nation east of the Rockies, with seven states ranking in the top ten coldest category for 1996. This pattern resulted in a temperature rank of 47th coolest for the nation as a whole, or right about at the long-term mean (see Table 1 and Figure 11).

Unusual wetness characterized the annual precipitation pattern for 1996. Nineteen states (in the West, Ohio Valley, and mid-Atlantic to Northeast) ranked in the top ten wettest category, while no states ranked in the top ten driest category.

It should be emphasized that all of the temperature and precipitation ranks on these maps and in the tables are based on preliminary data. The ranks will change when the final data are processed.

U.S. NATIONAL TEMPERATURE, JAN–DEC 1996 PERCENT AREA AND TEMPERATURE DEPARTURE

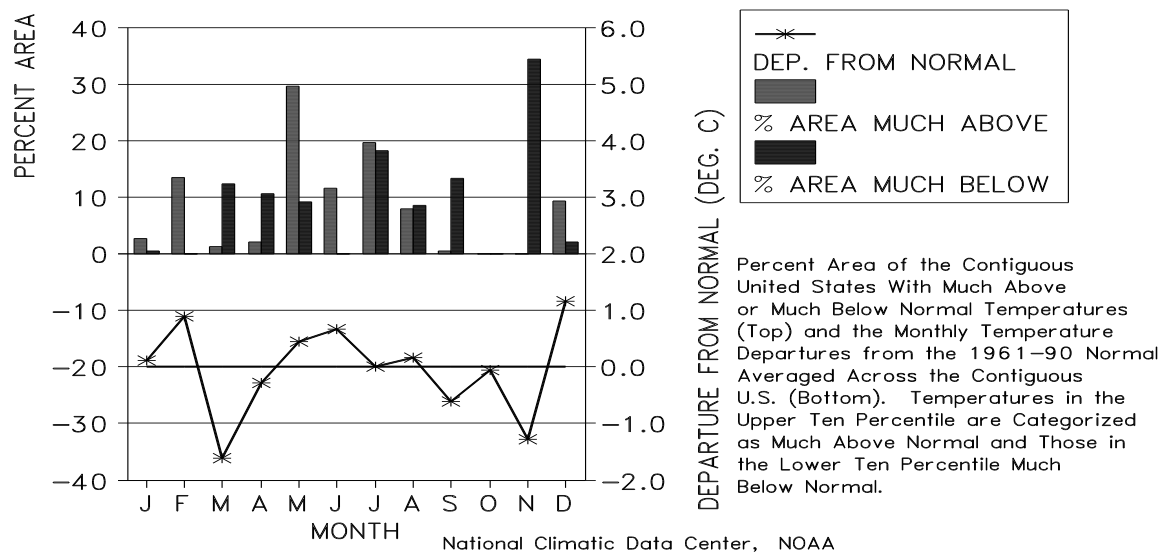


Figure 25: Large parts of the contiguous U.S. experienced extreme monthly temperatures during 1996. The nation, as a whole, averaged well below normal during March and November, and well above normal during February, May, June, and December.

U.S. NATIONAL PRECIPITATION, 1996 PERCENT AREA AND PRECIPITATION INDEX

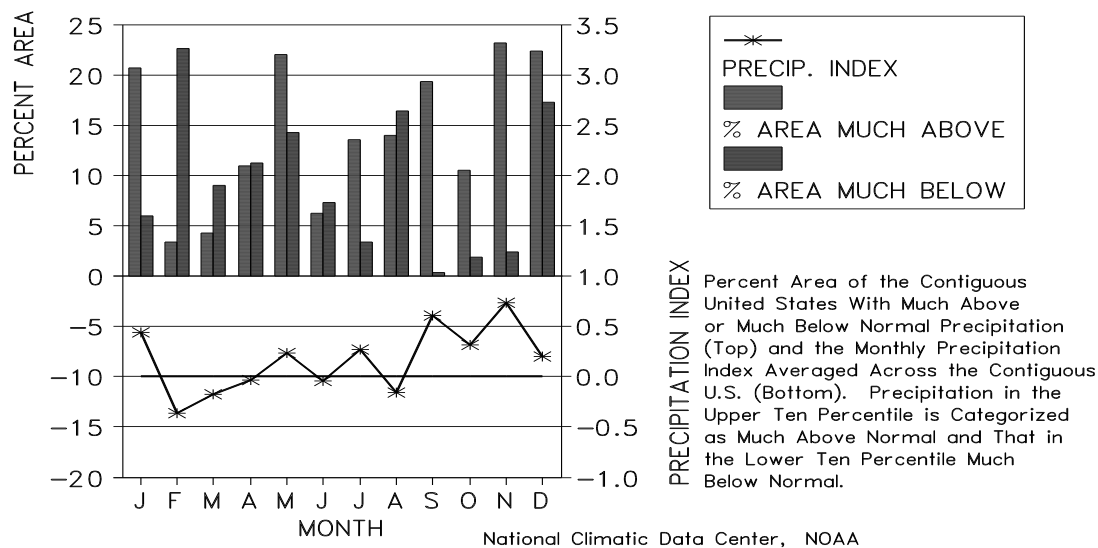


Figure 26: Large parts of the contiguous U.S. experienced extreme monthly precipitation anomalies during 1996. Monthly precipitation, averaged across the nation, showed an overall increasing trend from the anomalously dry conditions of February to the unusually wet national conditions of Autumn and early Winter.

NUMBER OF OBSERVED TORNADOES, U.S.A. JANUARY–DECEMBER, 1953–96

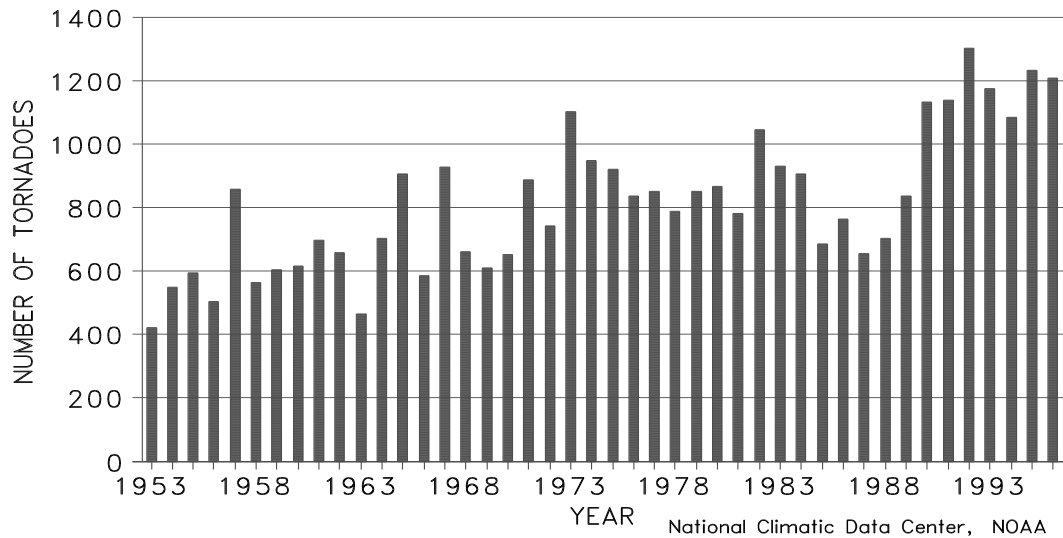


Figure 27: Preliminary statistics: 1208 tornadoes in 1996 compares to 1953-95 average of 808. Maximum of 1302 occurred in 1992, minimum of 421 in 1953. The preliminary count (i.e., for 1996) is generally higher than the final count. Tornado observations have generally improved with time as better observing practices and instrumentation (especially weather radar and satellites) were utilized.

NUMBER OF HURRICANES & TROPICAL STORMS NORTH ATLANTIC, 1886–1996

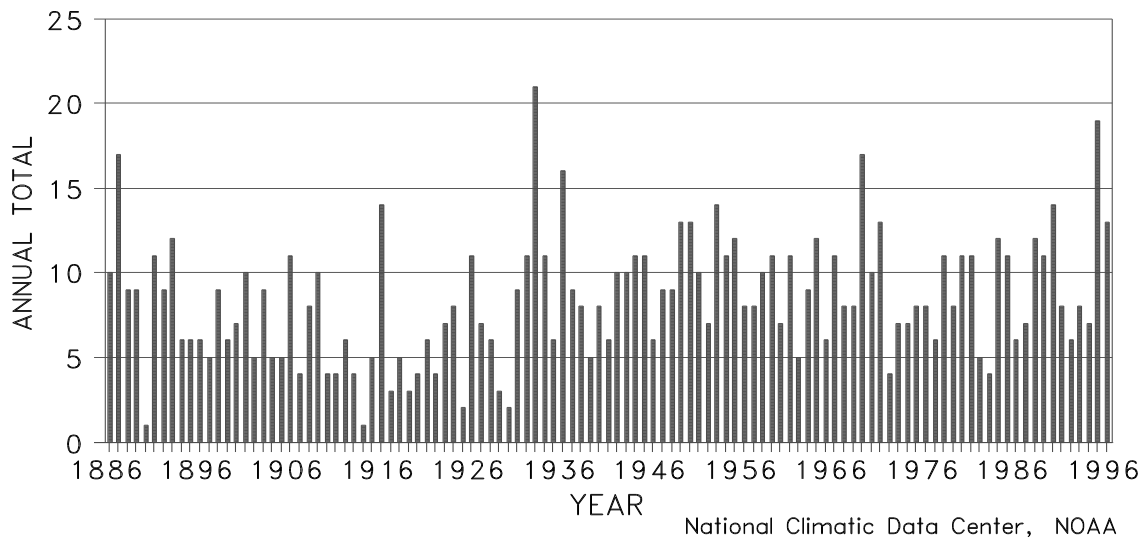


Figure 28: There were 9 hurricanes and 4 tropical storms during the 1996 North Atlantic hurricane season. The 1996 total of 13 was well above the 1886-1995 average of 8 hurricanes and tropical storms.

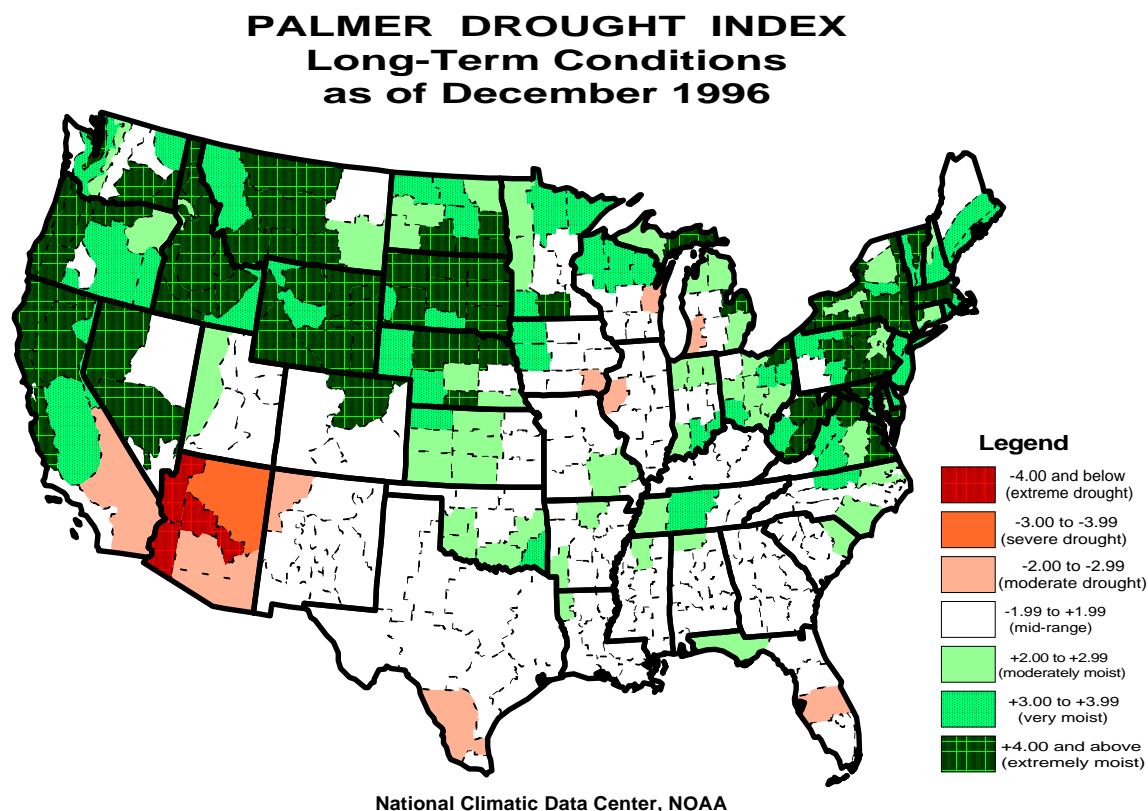
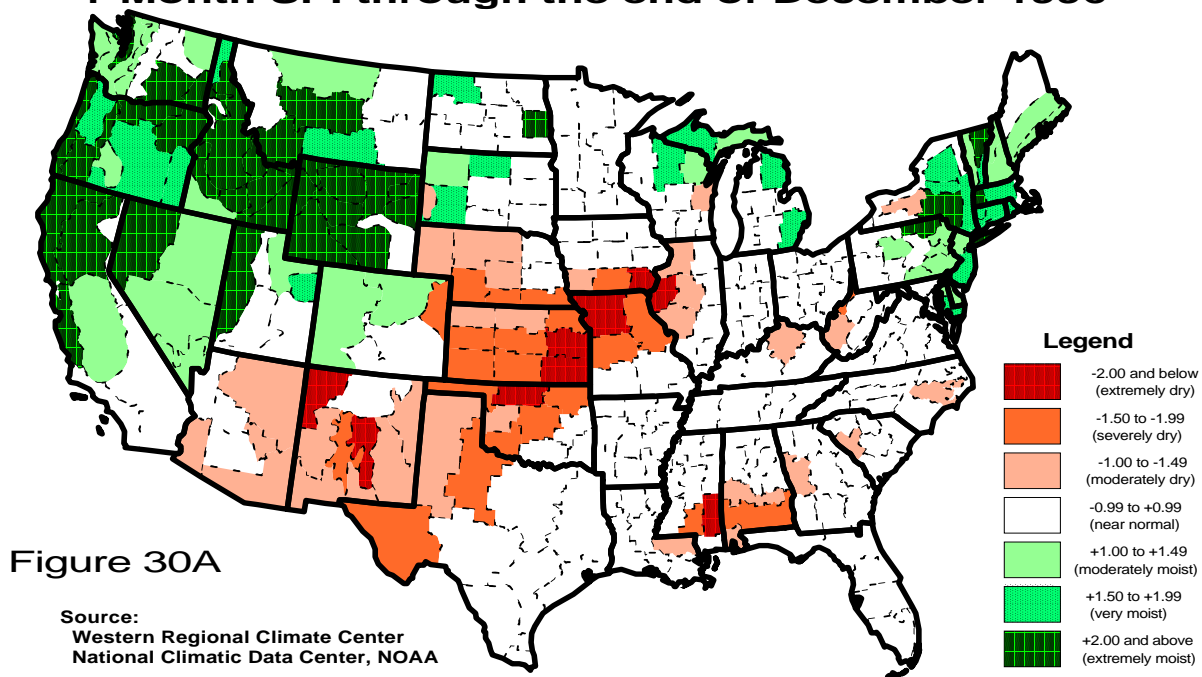


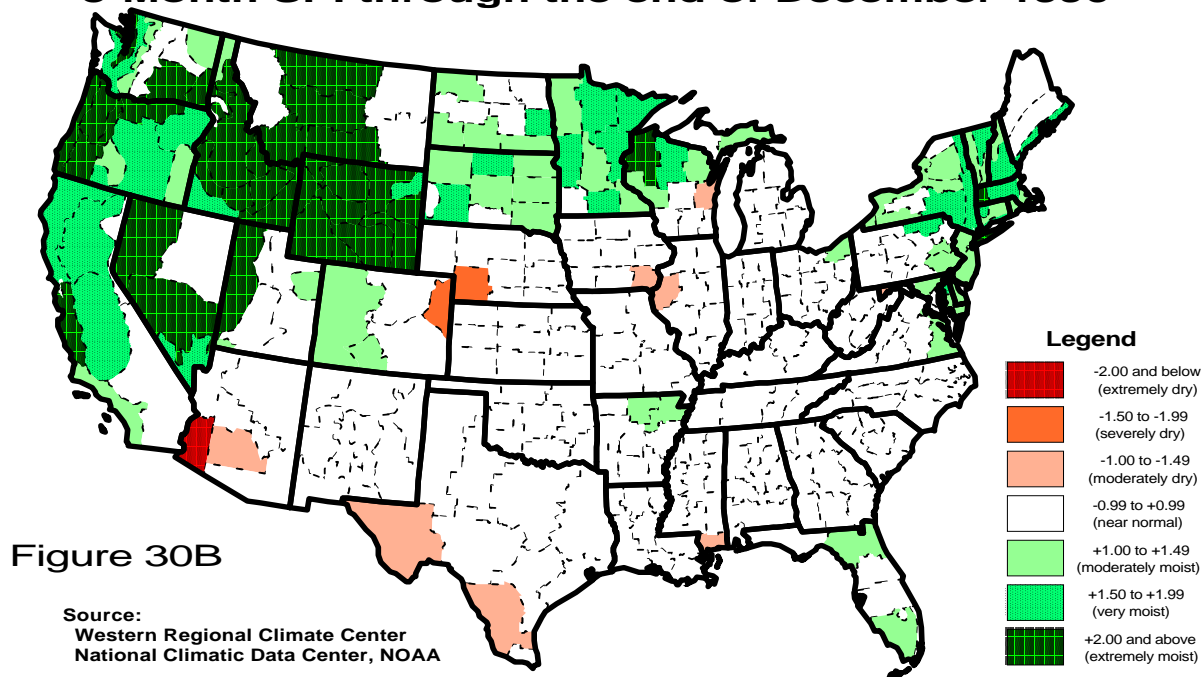
Figure 29: The Palmer Drought Index (PDI) is a measure of how the long-term, or cumulative, water supply (mainly precipitation) in an area compares to its water demand (mainly evapotranspiration). This water balance model was developed by Wayne Palmer in the 1960's and has become widely used in the United States. PDI values less than zero indicate water demand is greater than supply, with values less than -3.00 indicating severe to extreme drought (shaded red above). Positive values indicate water supply is greater than demand, with values greater than +3.00 indicating severe to extreme wet spell (shaded green above).

The PDI map for December 1996 shows an area of severe to extreme drought centered in the Desert Southwest, with patches of moderate drought in southern Texas, central Florida, and the mid-Mississippi Valley to western Great Lakes. A large area of severely to extremely wet conditions stretches from the West Coast to the northern and central Plains, from parts of the Ohio Valley to the Northeast, and across the northern Great Lakes.

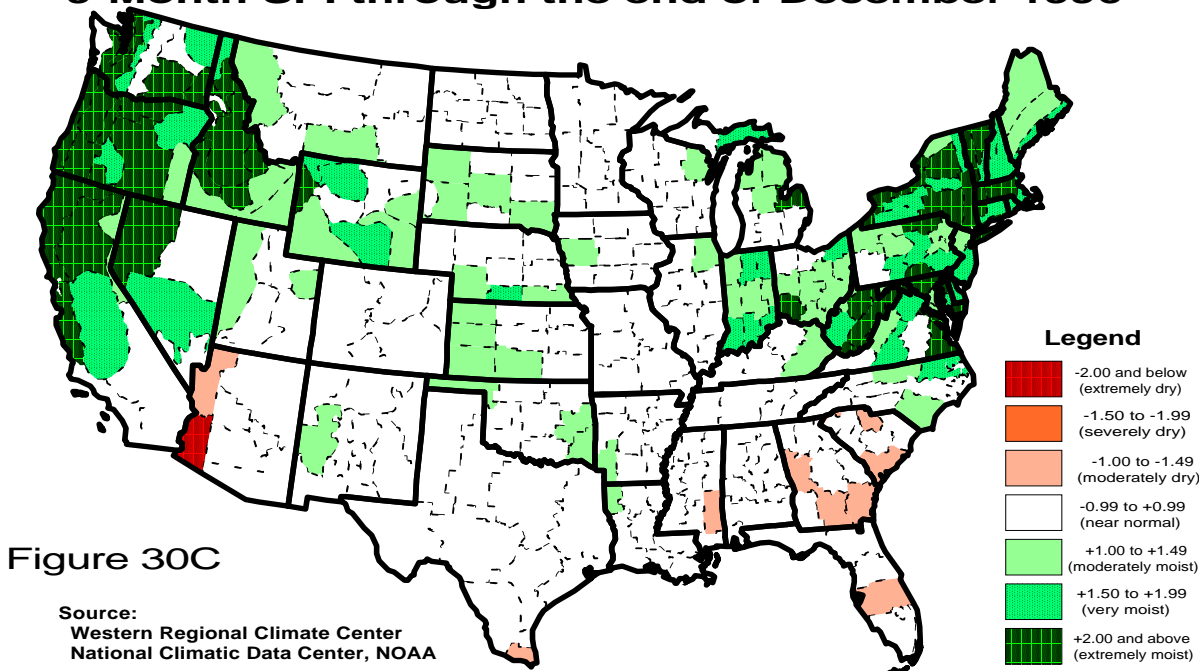
**STANDARDIZED PRECIPITATION INDEX
(By Climatic Division)
1-Month SPI through the end of December 1996**



**STANDARDIZED PRECIPITATION INDEX
(By Climatic Division)
3-Month SPI through the end of December 1996**



STANDARDIZED PRECIPITATION INDEX (By Climatic Division) 9-Month SPI through the end of December 1996



The SPI is a standardized precipitation index which is computed over several monthly intervals. Standardized precipitation is the difference of precipitation from the mean for a specified time period divided by the standard deviation, where the mean and standard deviation are determined from past records. The SPI, as developed by Colorado State University scientists led by Dr. Tom McKee, uses a statistical transformation of the historical data to compensate for the data's skewed distribution. The resulting computation of standardized precipitation is linearly proportional to precipitation deficit and allows consistent comparison of moisture anomalies from one region to another. SPI values less than zero indicate drought, while positive values represent wet spells.

Maps of SPI for three averaging periods are shown in Figures 30A-C. The map for December 1996 (Figure 30A) shows dry anomalies (red shading) spreading from the Desert Southwest across the Plains to the mid-Mississippi Valley, and also clustered along the Gulf coast. Unusually wet conditions (green shading) occurred from the West Coast to the northern Plains, in the Great Lakes region, and in the Northeast.

Long-term (3-month and 9-month) dry conditions have pretty much ended (Figures 30B and 30C). Precipitation deficits in the severely to extremely dry categories for the 3-month October-December 1996 period (Figure 30B) are spotty in the Southwest and Central Plains, and moderate to extreme precipitation deficits for the 9-month April-December 1996 period (Figure 30C) are spotty in the Southwest, Southeastern U.S., and southern Texas.

Long-term wet conditions can be found in many parts of the country. Excessive precipitation for October-December is concentrated in the Pacific Northwest to northern Plains and from the mid-Atlantic to Northeast states (Figure 30B), and for April-December in the northwestern and northeastern quarters of the country (Figure 30C).

The long-term (i.e., 9-month) SPI anomaly pattern (Figure 30C) is similar to the Palmer Drought Index pattern (Figure 29). The overall patterns are similar because, while the computational methods differ, both indices measure moisture anomalies integrated over a long time period.

U.S. TEMPERATURE AND PRECIPITATION REGIONS

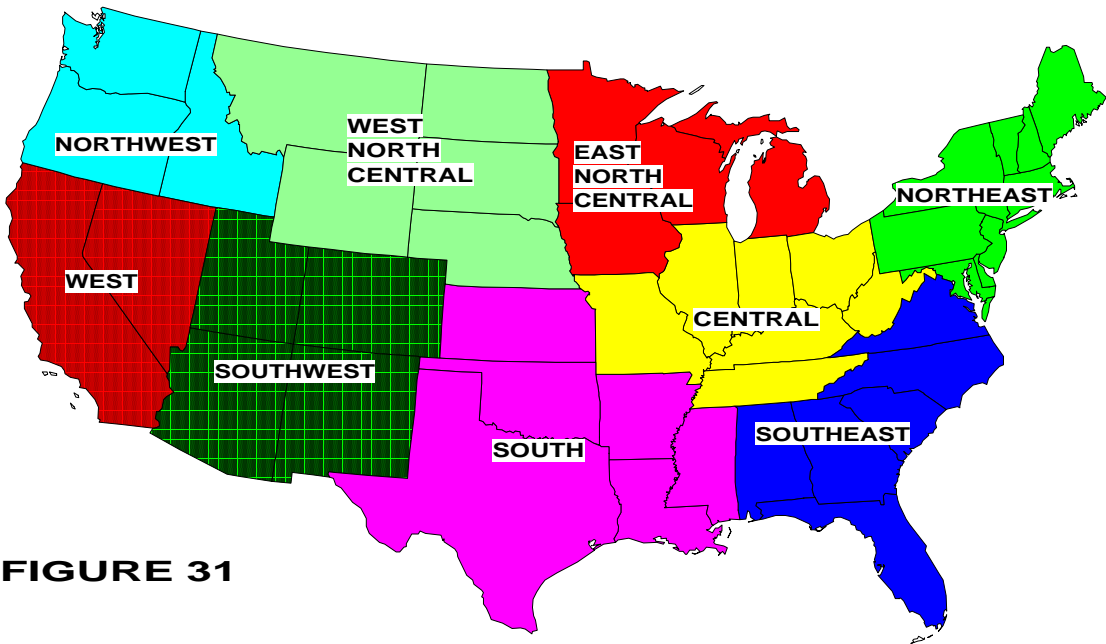


FIGURE 31

National Climatic Data Center, NOAA